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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MICHAEL L. CRABTREE

Appeal 2009-1447
Application 10/627,034
Technology Center 3600

Decided:¹ April 13, 2009

Before JENNIFER D. BAHR, LINDA E. HORNER, and
STEFAN STAICOVICI, *Administrative Patent Judges*.

STAICOVICI, *Administrative Patent Judge*.

DECISION ON APPEAL

¹ The two-month time period for filing an appeal or commencing a civil action, as recited in 37 C.F.R. § 1.304, begins to run from the decided date shown on this page of the decision. The time period does not run from the Mail Date (paper delivery) or Notification Date (electronic delivery).

STATEMENT OF THE CASE

Michael L. Crabtree (Appellant) appeals under 35 U.S.C. § 134 from the Examiner's decision rejecting claims 1-3, 12, and 15. Claims 4-11 and 13-14 have been canceled. We have jurisdiction over this appeal under 35 U.S.C. § 6 (2002).

THE INVENTION

The Appellant's invention is drawn towards an air spring having at least two plies, wherein the helix angle of the cord of the inner ply is greater than the helix angle of the cord of the outer ply. Specification 1, ll. 10-14 and figs. 1 and 2.

Claim 1 is representative of the claimed invention and reads as follows:

1. An air spring sleeve comprising:
 - an elastomer body having first and second ends configured to be coupled to first and second structures;
 - a first cord embedded in the elastomer body, the first cord wound with a first helix angle with respect to a sleeve centerline and extending from said first end to said second end;
 - a second cord embedded in the elastomer body, the second cord wound with a second helix angle with respect to a sleeve centerline and extending from said first end to said second end;
 - the first helix angle and the second helix angle describe a differential helix angle;
 - the first cord is disposed radially inward of the second cord; and

the first helix angle is greater than the second helix angle.

THE REJECTIONS

The Examiner relies upon the following as evidence of unpatentability:

Hirtreiter	US 3,897,941	Aug. 5, 1975
Warmuth, II ²	US 4,741,517	May 3, 1988

The Appellant seeks review of the Examiner's rejection of claims 1-3, 12, and 15 under 35 U.S.C. 103(a) as unpatentable over Warmuth in view of Hirtreiter.

THE ISSUE

Has the Appellant demonstrated that the Examiner erred in concluding that it would have been obvious for a person of ordinary skill in the art to modify the cords of Warmuth in view of the teachings of Hirtreiter such that the bias (helical) angle of the inner cord is greater than the bias (helical) angle of the outer cord?

SUMMARY OF DECISION

We REVERSE.

FINDINGS OF FACT

The following enumerated findings of facts (FF) are supported by at least a preponderance of the evidence. *Ethicon, Inc. v. Quigg*, 849 F.2d

² Hereafter referred to as Warmuth.

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1422, 1427 (Fed. Cir. 1988) (explaining the general evidentiary standard for proceedings before the Office).

1. Warmuth discloses an air spring 10 having a cap 12, a piston 14, a flexible membrane 18, and a fabric restraining cylinder 40. Warmuth, col. 3, ll. 14-20; col. 3, l. 65 through col. 4, l. 1; and fig. 1.
2. The flexible membrane 18 includes two layers of cords 29 and 31 that are arranged at predetermined bias angles 25 and 27, respectively. Warmuth, col. 3, ll. 37-41 and fig. 3B. Similarly, the fabric restraining cylinder 40 includes two layers of cords 41 and 42 that are arranged at equal predetermined bias cord angles 45 and 47, respectively. Warmuth, col. 4, ll. 1-12 and fig. 4B. The bias angles 45 and 47 of the fabric layers of the restraining cylinder 40 are greater than the biasing angles 25 and 27 of the fabric layers of the flexible membrane 18. Warmuth, col. 6, ll. 47-51 and figs. 3B and 4B.
3. The fabric restraining cylinder 40 reduces the axial and radial stress in the rolling portion 32 of the flexible membrane 18. Warmuth, col. 4, ll. 63-65. In use the flexible membrane 18 forms a meniscus 32 that rolls up and down the outer periphery of the piston 14 forming a rolling lobe. Warmuth, col. 3, ll. 53-57 and fig. 1.
4. Hirtreiter discloses an air spring 1 having a *flexing portion* 11 or 30 and a *non-flexing connecting portion* 13 or 31. Hirtreiter, col. 4, ll. 42-44; col. 7, ll. 34-41; and figs. 1 and 10. During the operation of the spring the flexing portion 11 undergoes a flexing rolling motion and non-flexing connecting portion 13 does not undergo a flexing rolling motion. Hirtreiter, col. 4, ll. 47-53 and fig. 8.
5. The flexing portion includes fabric layers or plies 7 and 8 having a plurality of cords 9 that extend along the entire body of the air spring

- 1 and are oriented at an “as molded” angle of approximately 35° to 50°. Hirtrieter, col. 4, ll. 27-31 and col. 7, ll. 3-6 and fig. 1. The non-flexing connecting portion 13 includes cords 17 that are wrapped around plies 7 and 8 at an “as molded” angle of approximately 20° to 30° to form reinforcement 16. Hirtrieter, col. 4, l. 61-63³ and col. 6, l. 68 through col. 7, l. 2 and fig. 1.
6. The cords 17 of the reinforcement 16 in the non-flexing connecting portion 13 of Hirtrieter are composed of high modulus metal filaments that are generally less flexible than the cords 9 of the inner plies 7 and 8 and the oriented (biased angle) such as to achieve optimum stiffness and rigidity. Hirtrieter, col. 5, ll. 5-9 and 43-45.
7. The non-connecting portion 13 reduces buckling or distortion of the air spring 1 during its compression, *i.e.*, buckling or distortion of the flexing portion 11. Hirtrieter, col. 5, ll. 2-4; col. 7, ll. 25-33; and figs. 9 and 9A.

PRINCIPLES OF LAW

Obviousness

Section 103 forbids issuance of a patent when “the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.”

³ Hirtrieter refers in col. 4, ll. 61-63 to “reinforcement 16” and “elements 16.” Emphasis in Hirtrieter. We believe this is a typographical error and that Hirtrieter is actually referring to elements 17.

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KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, __, 127 S. Ct. 1727, 1734 (2007).

The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art, (2) any differences between the claimed subject matter and the prior art, (3) the level of skill in the art, and (4) where in evidence, so-called secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966). See also *KSR*, 550 U.S. at __, 127 S. Ct. at 1734 ("While the sequence of these questions might be reordered in any particular case, the [*Graham*] factors continue to define the inquiry that controls.")

The Supreme Court stated that in cases involving more than the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement, it will be necessary to "determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *Id.* at 1740-41. The Court noted that "[t]o facilitate review, this analysis should be made explicit." *Id.* at 1741 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness")).

Rejections based on 35 U.S.C. § 103 must rest on a factual basis. In making such a rejection, the examiner has the initial duty of supplying the requisite factual basis and may not, because of doubts that the invention is patentable, resort to speculation, unfounded assumptions or hindsight reconstruction to supply deficiencies in the factual basis. *In re Warner*, 379 F.2d 1011, 1017 (CCPA 1967).

Where the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, the proposed modification would not have been obvious. *See Tec Air Inc. v. Denso Mfg. Michigan Inc.*, 192 F.3d 1353, 1360 (Fed. Cir. 1999); *In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984). "A reference may be said to teach away when a person of ordinary skill, upon [examining] the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant." *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994).

OPINION

The Appellant argues that the Examiner relies on the

helix angle of the steel wire cords 17 of the connecting portion 13 [of Hirtreiter] for allegedly teaching that the helix angles of the inner cords of Warmuth II et al can be larger than the helix angle of the outer cords.

App. Br. 5. Moreover, according to the Appellant, the combination is improper because:

the function of the steel wire cords 17 of the connecting portion 13 [of Hirtreiter] is entirely different than the fabric cords 29, 31 of Warmuth II et al. The purpose of the connecting portion 13 of Hirtreiter is specifically disclosed as being "a non-flexing generally cylindrical connecting portion 13."

App. Br. 5. Emphasis in original. *See also* Reply Br. 2.

In other words, the Appellant is arguing that because the steel wire cords 17 of Hirtreiter form a "non-flexible portion," whereas the cords 29 and 31 of Warmuth are part of a flexible membrane, *i.e.*, a flexible portion, a

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person of ordinary skill in the art would not have been prompted to modify the equally biased (helical) angles of the cords of the flexible membrane 18 of Warmuth with the unequally biased (helical) angles of the “non-flexible” portion cords of Hirtreiter, as suggested by the Examiner.

As noted above, rejections based on 35 U.S.C. § 103 must rest on a factual basis and the Examiner has the initial duty of supplying the requisite factual basis. In this case, the Examiner used the teachings of Hirtreiter merely to show that it is known to have differential helix angles between the cords of the inner and the outer layers of an air spring. Ans. 5. Specifically, the Examiner determined that:

It would have been obvious to one of ordinary skill in the art to modify the cords of Warmuth with [a] helix angle of the first cord [that] is greater than the helix angle of the second cord and the differential helix angle is in the range of approximately 0 to 5 degrees or 0 to 2.5 degrees, as taught by Hirtreiter et al., *in order to optimize the dynamic flexibility of the sleeve* depending upon the type of application.

Ans. 4. Emphasis added.

However, the Examiner has not provided any factual basis to show that modifying the equally biased (helical) angles between the inner and the outer cords of the flexible membrane (sleeve) of Warmuth with the differentially biased (helical) angles of the non-flexing connecting portion of Hirtrieter necessarily optimizes the dynamic flexibility of the flexible membrane (sleeve) or that a person of ordinary skill in the art would understand this to be the case. Although the flexible membrane 18 of Warmuth includes two layers of cords 29 and 31 that are arranged at equal predetermined biased (helical) cord angles 25 and 27 (FF 2), the Examiner

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has not provided any factual basis to show that the flexible membrane of Warmuth lacks dynamic stability.

The dynamic flexibility of the cylindrical sleeve of Warmuth is determined by other factors in addition to the biased (helical) angles of the cords. Such factors include the material properties of the cords, the cross-sectional area of the cords, and the type of loading. Without taking these factors into consideration, we find that it is not clear that merely providing a differentially biased (helical) angle between the inner and the outer cords in the flexible membrane (sleeve) of Warmuth would “optimize the dynamic flexibility of the sleeve,” as suggested by the Examiner.

Furthermore, we note that the metallic filaments forming the cords 17 and the differentially biased (helical) angle formed between the cords 9 of the inner plies 7 and 8 and the cords 17 of the outer, reinforcement 16 of Hirtrieter reduces buckling or distortion of the air spring during its compression (FF 5-7). As found above, the fabric restraining cylinder 40 of Warmuth reduces the axial and radial stresses in the rolling meniscus portion 32 of the flexible membrane 18 (FF 3). Hence, since the axial and radial (hoop) stresses in the flexible membrane 18 of Warmuth are reduced, a person of ordinary skill in the art would have readily appreciated that the buckling or distortion of the air spring of Warmuth during its compression is also reduced. As such, providing a differentially biased (helical) angle, as taught by Hirtrieter, between the inner and the outer cords of the flexible membrane of Warmuth, as suggested by the Examiner, appears to be superfluous.

Moreover, in view of the teachings of Hirtrieter, the same person of ordinary skill in the art would have reasonably recognized that providing a differentially biased (helical) angle between the inner and the outer cords of

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the flexible element of Warmuth would increase its stiffness and rigidity, hence would reduce its ability to form a rolling portion (meniscus 32) that rolls up and down the outer periphery of the piston, as is required by the air spring of Warmuth to function as intended.

We thus find that the modification proposed by the Examiner of providing differentially biased (helical) angles between the inner and the outer cords of the flexible membrane (sleeve) of Warmuth, as taught by Hirtreiter, would not have been obvious to the person of ordinary skill in the art. Moreover, we find that the teachings of Hirtreiter would have discouraged a person of ordinary skill in the art from providing differentially biased (helical) angles between the inner and the outer cords of the flexible membrane (sleeve) of Warmuth.

For the above stated reasons, we conclude that the Appellant has shown the Examiner erred in the conclusion of obviousness of the subject matter of claim 1. Therefore, we will not sustain the rejection of claim 1 or its dependent claims 2, 3, 12, and 15 under 35 U.S.C. § 103(a) as unpatentable over Warmuth in view of Hirtreiter. *See In re Fine*, 837 F.2d 1071, 1076 (Fed. Cir. 1988) (If an independent claim is nonobvious under 35 U.S.C. § 103, then any claim dependent therefrom is nonobvious).

CONCLUSION

The Appellant has demonstrated that the Examiner erred in concluding that it would have been obvious for a person of ordinary skill in the art to modify the cords of Warmuth, in view of the teachings of Hirtreiter, such that the bias (helical) angle of the inner cord is greater than the bias (helical) angle of the outer cord.

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DECISION

The decision of the Examiner to reject claims 1-3, 12, and 15 is reversed.

REVERSED

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